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10/065,738	11/14/2002	Soichiro Okubo	39.003-AG	6181

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EXAMINER

JUBA JR, JOHN

ART UNIT PAPER NUMBER

2872

DATE MAILED: 07/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/065,738

Applicant(s)

OKUBO ET AL.

Examiner

John Juba

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 May 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-6,8 and 10-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 14,15,20 and 21 is/are allowed.
- 6) ☒ Claim(s) 1,3-6,8,10-13 and 16-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 November 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "at least two magneto-optic parts" and the "at least one dielectric layer" interlaminated therebetween must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

Claim 5 is objected to because of the following informalities: In claim 5 (line 2), "multi-layer film" should read "multi-layer films". Appropriate correction is required.

Applicants' amendment is objected to under 37 CFR 1.52 (b)(2)(i) which requires that *any amendments* be in lines that are 1½ or double-spaced. The examiner appreciates that this is not made abundantly clear in 37 CFR 1.121 as now revised. However, the claims now presented as a facsimile transmission of single-spaced lines with both interlineations and underlining are exceedingly difficult to read, and cannot be scanned for publication. Appropriate correction is required.

Claim Rejections - 35 USC § 112

Claims 1, 3 – 5 , 6, 8, 10 – 13, 18, and 19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Each of claims 1 and 6 recites the multi-layer films as being disposed “on either side” of the magneto-optic section. The expression “either” has common usage both as meaning “either” (one or the other; e.g., to use *either* hand) and as meaning “each” (one and the other; e.g., to have a tool in *either* hand). [Webster's New World Dictionary, 3rd College Ed.] In light of the illustration of the films on both sides of the magneto-optic section, the examiner believes this recitation to mean that the multi-layer films to be disposed “on *each* side” of the magneto-optic section. On the other hand, there is nothing in the claim to preclude a multi-layer on a single side from cooperating with the “at least one dielectric layer” that is interlaminated within the magneto-optic section to define a resonant structure. Thus, the claims are ambiguous as to which of two conditions is meant. In cases where the meaning of a term or expression used in the claims is not clearly defined, current Office practice is *not* to read limitations into the claims (e.g., in stated reasons for allowance), but to have Applicants amend the specification or claims such that the meaning and intended scope is clear. Claims 3 – 5, 8, 10 – 13, 18, and 19 are rejected as inheriting the same ambiguity through their various dependency from claim 1 or 6.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 16 and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Anthony, et al. Referring to Figure 4 and the associated text, Anthony, et al disclose a 300 μm thin film of diamond-like carbon (a-C:H) having an extinction coefficient not exceeding 3×10^{-4} over the wavelength range of 1200 – 1700 nm. Anthony, et al plot Absorbance values of about 0.4 at 1200 nm and about 0.1 at 1700 nm. Manipulating equations (1) and (2) of the reference, the Absorbance can be expressed as $A=k \cdot b$, where "k" is the *absorption* coefficient, and b is the thickness. [Customarily, "k" is the *extinction* coefficient, and " α " is used for the absorption coefficient.] The examiner's math is noted on Figure 4, where values of 1333.3 m^{-1} and 333.3 m^{-1} were obtained for the absorption coefficients at 1200 nm and 1700 nm respectively. [Units of cm^{-1} are frequently used, but the examiner prefers to express this coefficient and the wavelength directly in whole meters.] The *extinction* coefficient is related to the absorption coefficient as:

$$ext.coeff = \frac{abs.coeff \cdot \lambda}{4\pi}$$

Making the necessary substitutions at wavelengths of $1200 \cdot 10^{-9}$ and $1700 \cdot 10^{-9}$ meters, the examiner arrived at extinction coefficients of about 1.27×10^{-4} (at 1200 nm) and 4.51×10^{-4} (at 1700 nm).

With particular regard to claim 17, Anthony, et al teach that the film is suitable for use in any of a variety of glazing applications (Col. 5, line 4). Since a glazing covers an optical aperture, the thin film of Anthony, et al fairly constitutes an "optics component" within the specificity recited. Specific instances of use of the film as an optical component are when the film is attached to the entrance aperture of the integrating sphere (Col. 3, lines 60+) or across the entrance aperture of the photomultiplier tube (Col. 5, lines 67+)

Claims 1, 5, 6, and 13 are rejected under 35 U.S.C. 102(e) as being anticipated by Matsushita, et al (U.S. Patent Application Pub 2002/0063941 A1). Referring initially to Figure 6 and the associated text and noting the detailed construction of assembly 10A shown in Figure 1, Matsushita, et al disclose an optical isolator having wavelength selectivity comprising a magneto-optical section (31)(29)(23)(27)(28), a magnetic part (4), and dielectric multi-layer films (30) and (26) on either side of the magneto-optic section comprising alternating layers (24)(25) of high and low refractive index material, and polarizers (2A)(2B). The magneto-optic section thus comprises at least one dielectric layer (29), (23), or (27) interlaminated to create at least two magneto-optical parts (31) and (28) for rotating the polarization plane of incident light. Matsushita, et al

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expressly teach that each [magneto-optic] cavity thickness may be of $\lambda/2$ or a multiple of $\lambda/2$ (paras. [0057] & [0084]). Taking a multiple of 2, each cavity thickness will be $2 \cdot (\lambda/2)$. It should be readily apparent that the fundamental resonance will be at 2λ . But, Matsushita, et al make it clear that the cavity will also resonate at λ , since they disclose that the multiplied cavity length is still suitable for use at the "desired" wavelength, λ . Thus, at least the multiple half-wave embodiments of Matsushita, et al *inherently* exhibit localization and enhancement of the Faraday rotation at multiple (resonant) wavelengths. Further, a generally-recognized¹ inherent characteristic of Fabry-Perot structures such as that of Matsushita, et al, having a cavity index, n , and a cavity spacing, d , is that they resonate at each of a plurality of frequencies separated by a free spectral range given as $FSR = c/2 \cdot n \cdot d$. That is, Fabry-Perot structures have a response that is periodic in frequency. For example, considering a single half-wave cavity thickness for ($\lambda = 1.3 \mu\text{m}$), $n \cdot d = 0.650 \mu\text{m}$, leading to a $FSR = 3 \cdot 10^8 \text{ (m/sec)} / 1.3 \cdot 10^{-6} \text{ m} = 230.769 \text{ THz}$. As is well-known², the cavity will resonate at λ , $\lambda/2$, $\lambda/3$, $\lambda/4$, and so on (1300 nm, 650 nm, 433 nm, 325 nm . . .). Thus, the disclosed structure is an arrangement predetermined to create a resonant structure for localizing within said magneto-optical section, incident light of at least two wavelengths, as recited.

With regard to claims 5 and 13, notwithstanding the fact that the integrated assembly of Matsushita, et al involves vapor phase deposition of the dielectric layers, the recitation of the components as having been "formed integrally by a vapor-phase process" is not seen as imparting any positive *structural* limitation. As previously set

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forth, it is well-settled that the manner in which the thing is made is not germane to the patentability of the thing itself.

Note 1: See for example, Pelekhaty, U.S. Patent number 6,215,592 (Col. 5, lines 53+):

"It is known that a Fabry-Perot filter will transmit at a number of resonant frequencies. The frequency spacing between two adjacent transmission peaks, e.g., 50 and 52, is known as the free spectral range (FSR), and is defined by:

$$FSR = c/2nd \quad (\text{equation 1})$$

where c is the speed of light in a vacuum (2.998.times.10.sup.8 m/s), n is the refractive index of the material between the mirrors, e.g., the refractive index of spacer 36, and d is the distance between the mirrors, e.g., the thickness of the spacer. Advantageously, therefore, the FSR of the filter may be controlled by variation of the thickness and/or the refractive index of the spacer 36."

Note 2: See for example, HANDBOOK OF OPTICS Walter G. Driscoll, ed., sponsored by Optical Society of America, McGraw-Hill (c) 1978. pp. 8-75 thru 8-85:

$$\text{"Maxima T occur at wavelengths at } \lambda_0 = \frac{2nt \cos \varphi}{k - \varepsilon / \pi} \quad k = 0, 1, 2 \dots \quad (64) \text{"}$$

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 4 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsushita, et al (U.S. Patent Application Pub 2002/0063941 A1), in view of RICOH CO LTD (JP 11-030770 A; hereinafter "RICOH"). As set forth above for claim 1, Matsushita, et al disclose the invention substantially as claimed. However, Matsushita, et al do not disclose silicon oxide (SiO₂) and titanium oxide (TiO₂) as the low- and high-index layers.

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In the same field of endeavor, RICOH disclose a Faraday rotator arranged between alternating transparent dielectric layers in order to localize and enhance the magneto-optical effect. For this purpose RICOH teach that a variety of dielectric layer combinations can be used, but that silicon oxide (SiO_2) and titanium oxide (TiO_2) are generally sufficient (para. [0021]). One of ordinary skill would understand this to be a teaching of using the ubiquitous silica/titania combination known for its low cost attributable to its deposition parameters and relatively abundant raw materials.

It would have been obvious to one of ordinary skill to employ silicon oxide (SiO_2) and titanium oxide (TiO_2) as the dielectric layers in the Faraday rotator of Matsushita, et al, because these layers were an art-recognized equivalent for the purpose, as taught by RICOH. In the instant case, one of ordinary skill would have been motivated to select the titanium oxide over tantalum oxide in the interest of using a lower-cost sputtering target.

Allowable Subject Matter

The previous indication of claims 16 and 17 as being allowable is withdrawn in light of the newly discovered prior art to Anthony, et al. The examiner regrets the delay in applying this reference and apologizes for any inconvenience.

Claims 14, 15, 20, and 21 are allowable over the prior art. Claims 3, 8, 11, 12, 18, and 19 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph (above), and to include all of the limitations of the base claim and any intervening claims. The following is a statement of reasons for the

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indication of allowable subject matter: The prior art, taken alone or in combination, fails to teach or to fairly suggest

a magneto-optical part in combination with a dielectric multi-layer film of alternating low-index and high-index layers for localizing within said magneto-optical part incident light of at least one wavelength, particularly wherein the magneto-optical part is constituted from a gadolinium iron garnet thin film, as recited in claims 3 and 8; or

a polarizer in which a diamond-like carbon film has distributed refractive indices along a bias with respect to the film's thickness, as recited in claims 11 and 14.

Response to Amendment

Applicants' amendment of claims 4 and 12 is sufficient in overcoming the previous objection to these claims for an informality.

Applicants' cancellation of claim 9 obviates the rejection thereof under 35 U.S.C. § 112, first paragraph.

Applicants' amendment of claim 1 overcomes the rejection of claims 1 and 5 under § 102(b) as being anticipated by TOKYO INSTITUTE (JP 2000-162566 A). The cancellation of claim 2 obviates its rejection on these grounds. TOKYO INSTITUTE disclose a resonant embodiment (Fig. 1) with a multi-layer film of diverse refractive indices on each side of a magneto-optic element, and disclose an interlaminated embodiment (Fig. 2) comprising plural magneto-optic parts wherein multiple wavelengths are rotated (Fig. 5b). They do not however, suggest combining the two embodiments so as to anticipate the structure of claim 1.

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Applicants' amendment of claims 1 and 6 is sufficient in overcoming the previous rejection of claims 1, 4 – 6, 10, and 13 under §102(b) as being anticipated by RICOH CO (JP 11-030770 A), since RICOH CO do not disclose at least one dielectric layer interlaminated to form at least two magneto-optic parts, as now recited. The cancellation of claims 2 and 7, obviates their rejection on these grounds.

Applicants' remarks have been fully considered, but the examiner is not persuaded that the amendment to claims 1 and 6 is sufficient to distinguish over Matsushita, et al (U.S. Patent Application Pub 2002/0063941 A1). Accordingly, claims 1, 5, 6, and 13 stand rejected under § 102(e) as being anticipated by Matsushita, et al. The cancellation of claims 2 and 7 of course, obviates their rejection on these grounds.

As set forth in the rejection, it should be clear that the structure of Matsushita, et al *inherently* causes localization (*i.e.*, resonates) at at least two wavelengths. In support of this assertion, the examiner has included extrinsic evidence within the body of the rejection. [The inclusion of multiple references in a rejection, such as to demonstrate and inherent characteristic of the prior art, does not preclude a finding of anticipation. See citations, MPEP 2131.01 at III.] The Office has demonstrated set forth a reasonable basis to conclude that the element relied upon is *inherent* in the prior art. If such is not the case, then Applicant should demonstrate that this feature is not inherent. *In re Swinehart*, 169 USPQ 226 (CCPA 1971). Applicants' specification includes several "simulations" of resonant structures. The examiner believes that, if the structure disclosed by Matsushita, et al is "simulated" in the same manner, multiple resonances will be evident.

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Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Pelekhaty describe the multiple wavelength response of coupled Fabry-Perot filters.

G.A. Clarke, et al. (*Thin Solid Films* 280) characterize diamond-like carbon films over the 1200 – 1700 nm wavelength range ($6000 \sim 8000 \text{ cm}^{-2}$ wavenumbers) and disclose relatively high extinction coefficients.


S. Savvides (*J. Appl. Phys.* 59(12)) disclose diamond-like carbon films having relatively high extinction coefficients in the 1000 nm wavelength range.

HANDBOOK OF OPTICS (selected passages) describe the multiple wavelength response of Fabry-Perot filters.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Juba whose telephone number is (703) 308-4812. The examiner can normally be reached on Mon.-Fri. 9 - 5.

The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.


JOHN JUBA
PRIMARY EXAMINER
Art Unit 2872

July 9, 2003